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Market modelling based CBA to support the PECI selection process in the Energy Community

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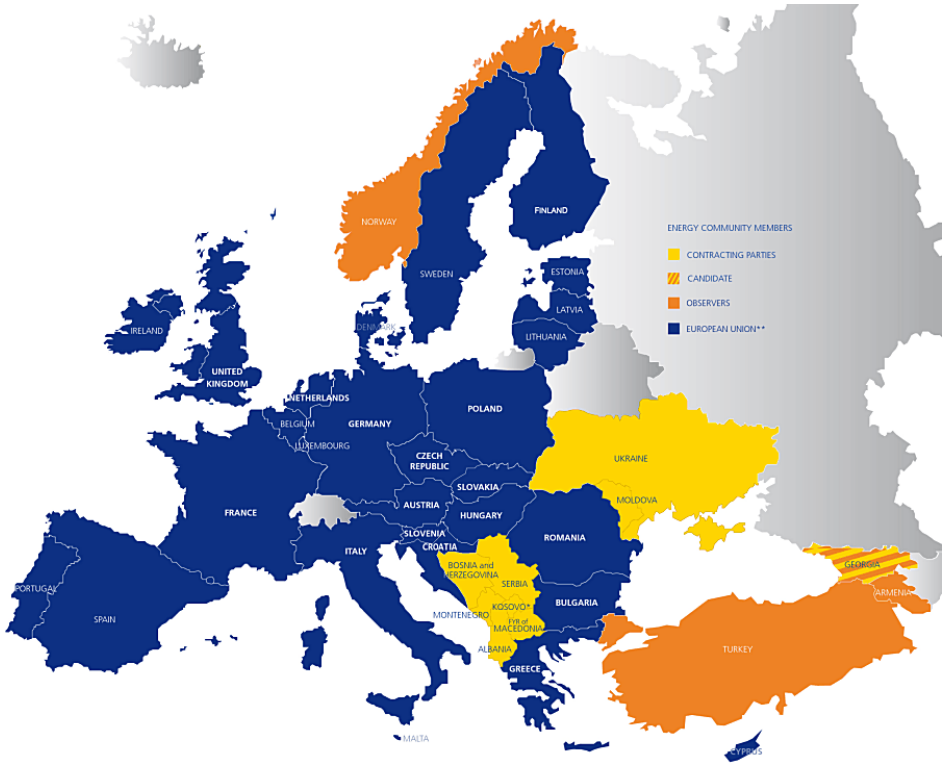
Outline

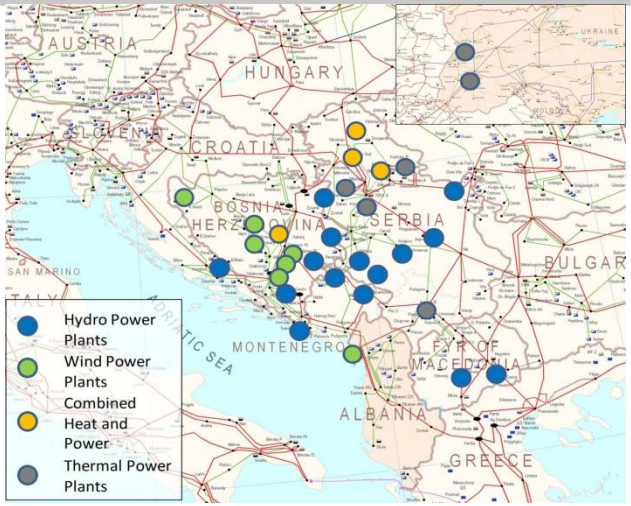
- The PECI selection process and methodology
- Elements of the CBA and modelling assumption
- The Danube Region Gas Market Model
- Illustrative results and sensitivity analysis
- Model extension: the European Gas Market Model (EGMM)

The Energy Community's PECI selection process

- July 2012: Energy Strategy of the Energy Community published
- Secretariat initiated work to identify Projects of Energy Community Interest (PECI)
- Project evaluation and ranking, including modelling based CBA: the consortium of KEMA, REKK and EIHP selected
- Process very similar to PCI
- 100 projects of €30 Bn promoted
- October 2013: Ministerial Council approved PECIs including 10 gas infra projects



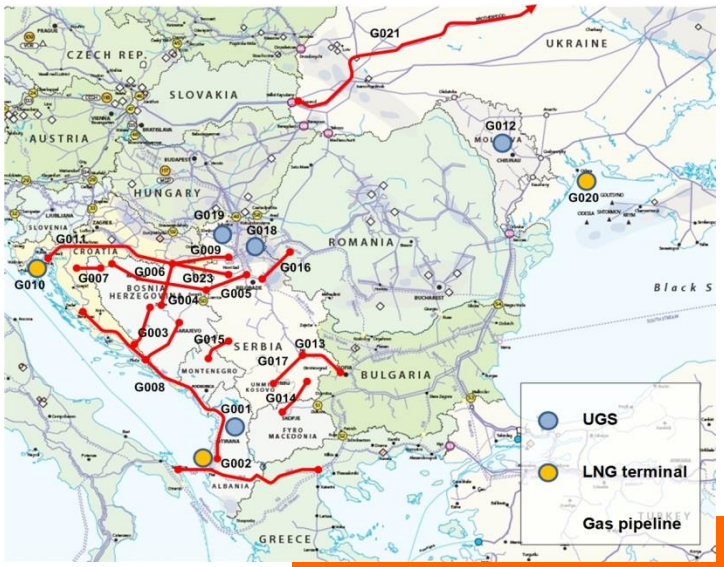
Promoted projects



Electricity generation (43)

Electricity infrastructure (30)

Gas infrastructure (23 + 4 oil)



Applied Project Assessment Methodology – 1

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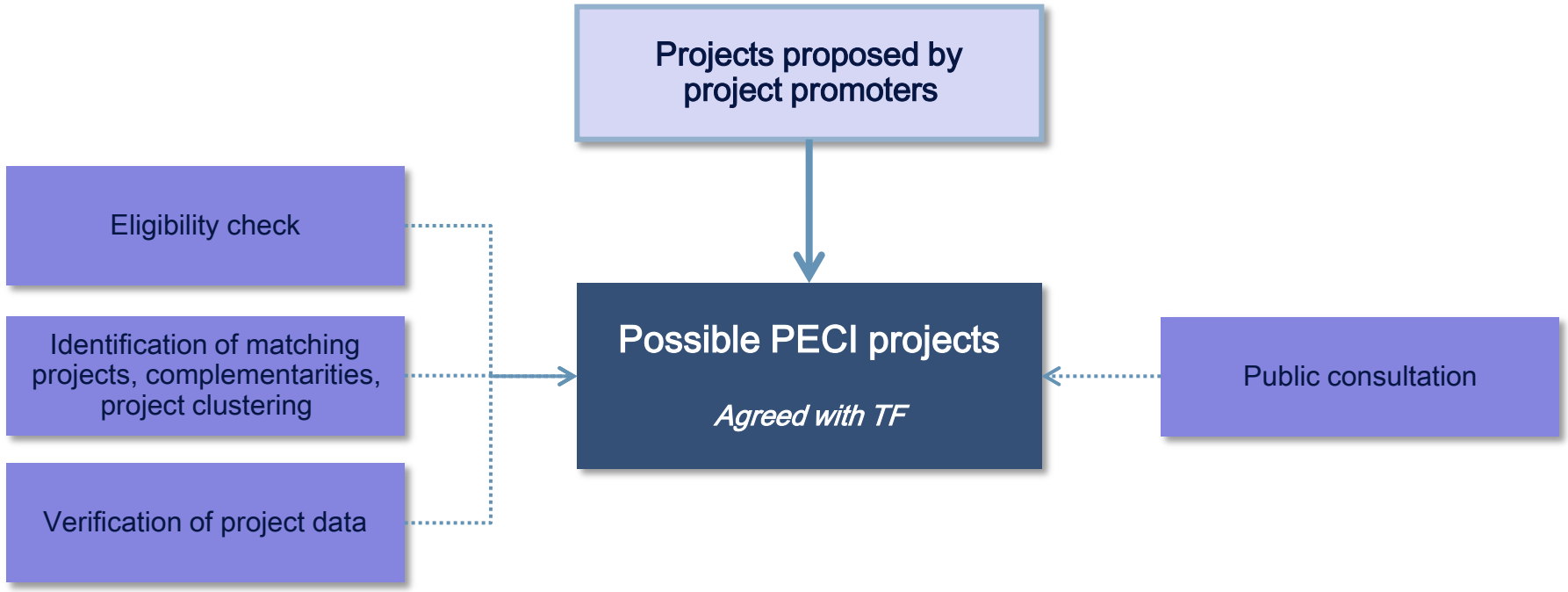
1 Pre-assessment



Applied Project Assessment Methodology – 2

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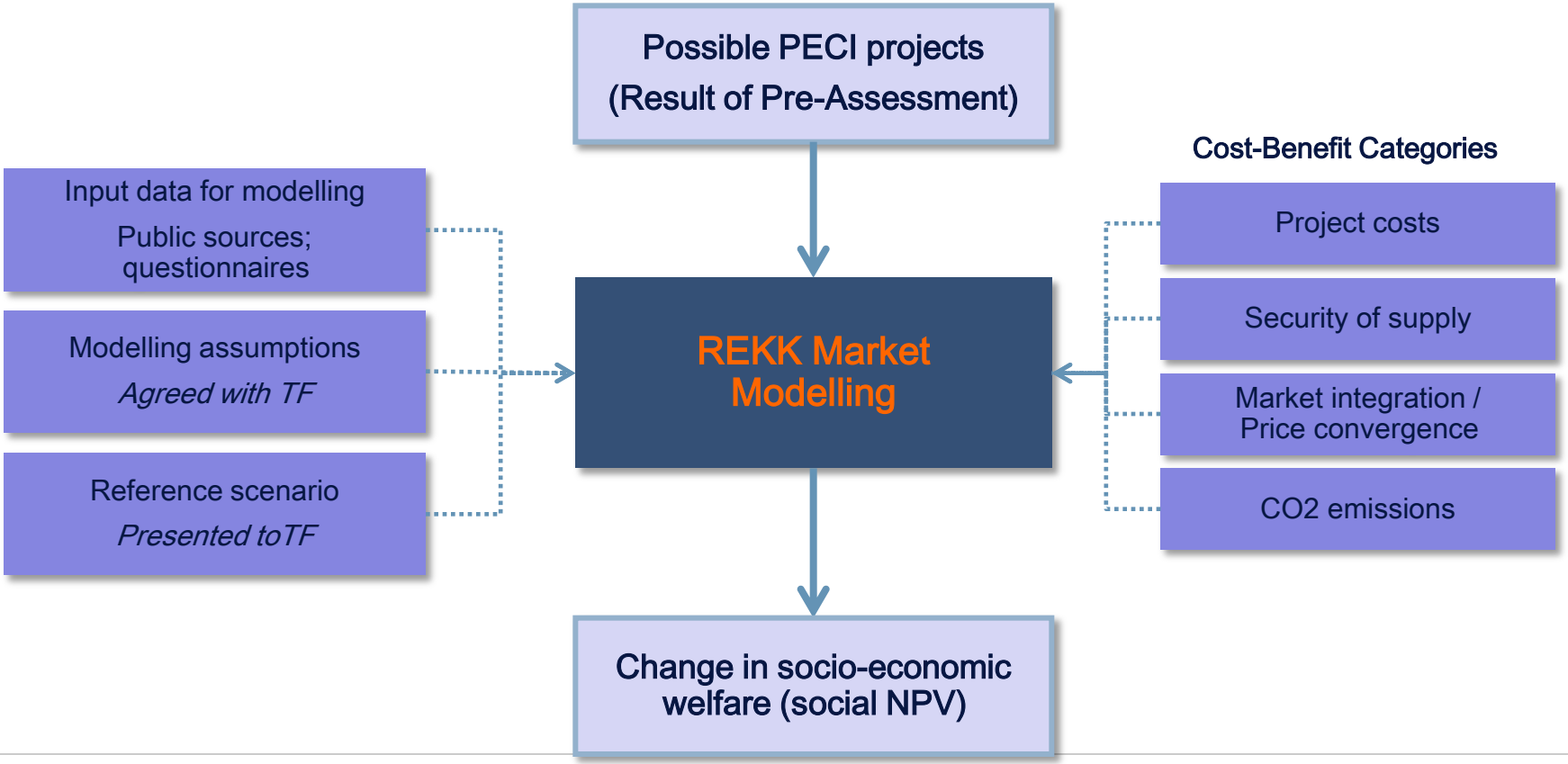
2 Economic Cost Benefit Analysis



Applied Project Assessment Methodology - 3

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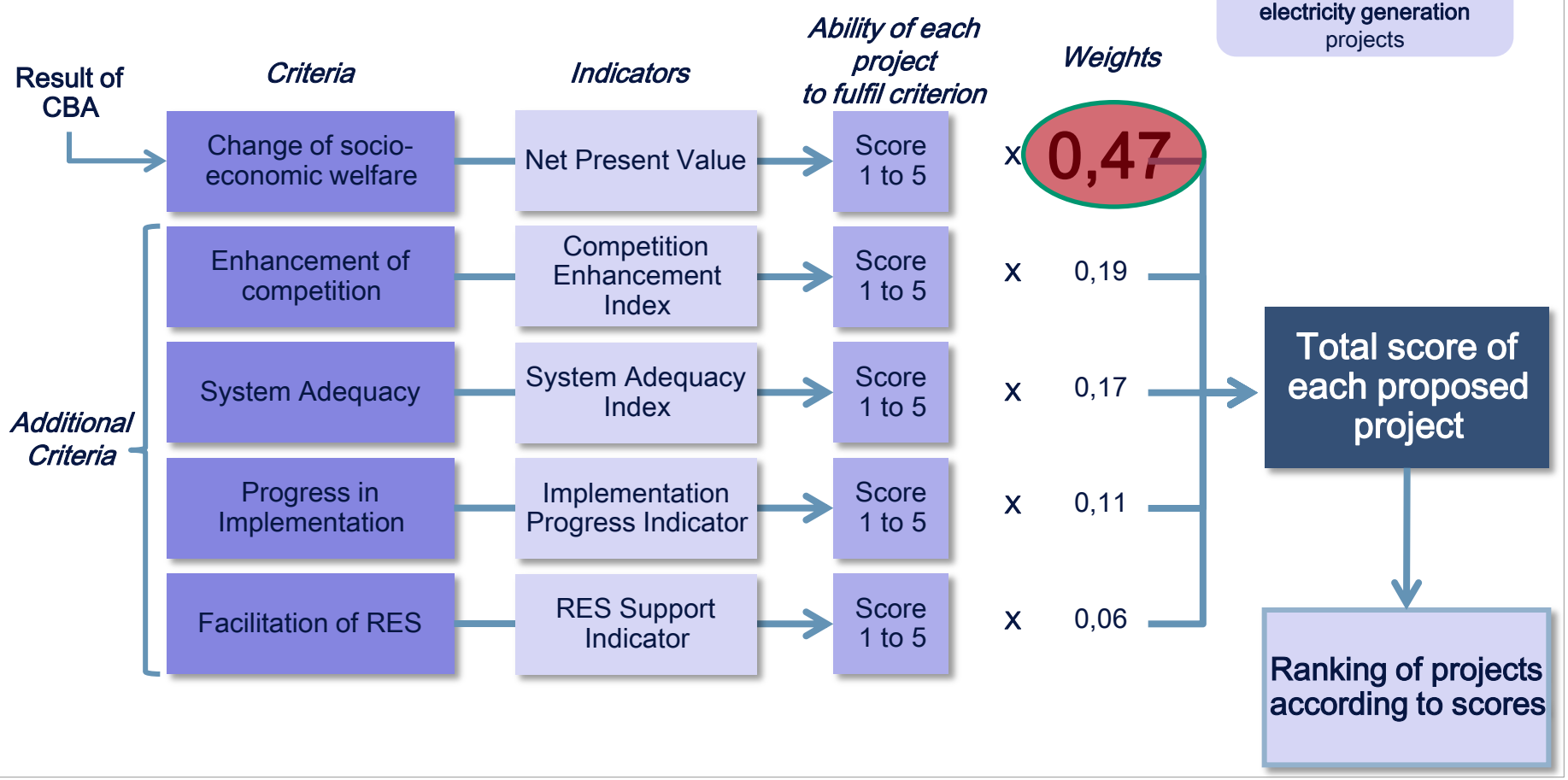
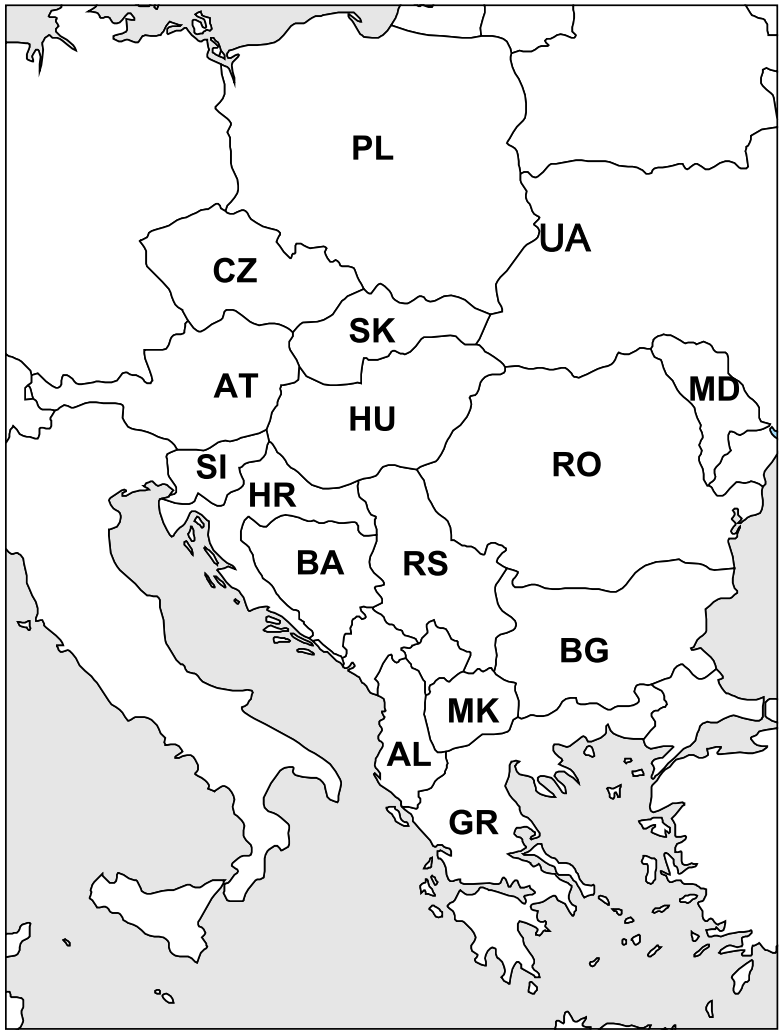
3 Multi-Criteria Assessment

Weights and criteria shown here applicable to **electricity generation** projects

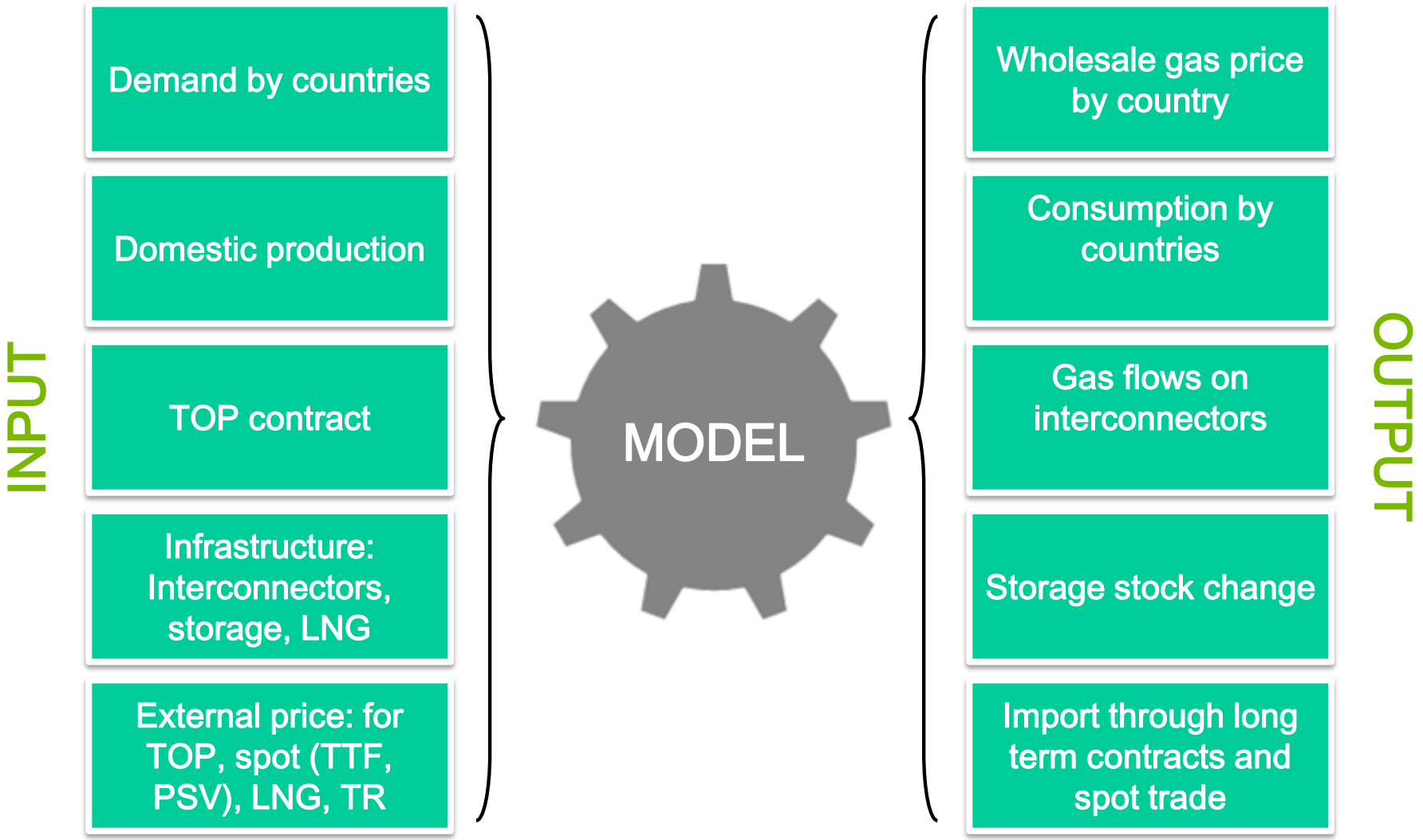


Danube Region Gas Market Model



- Geographical coverage of the model:
  - 16 countries –see map
- DRGMM:
  - Competitive market equilibrium prices by countries
  - Natural gas flows and congestions on interconnectors
- One year (12 months) are modelled
- Trade is based on long term contracts and spot trade within the DR and with exogenous countries (Russia, Germany, Italy, Turkey and Greek LNG)
- Physical constraints are interconnection capacities
- Trade constraints: TOP obligation
- Domestic production and storage facilities are included
- Transmission and storage fees are included (assessed by REKK)

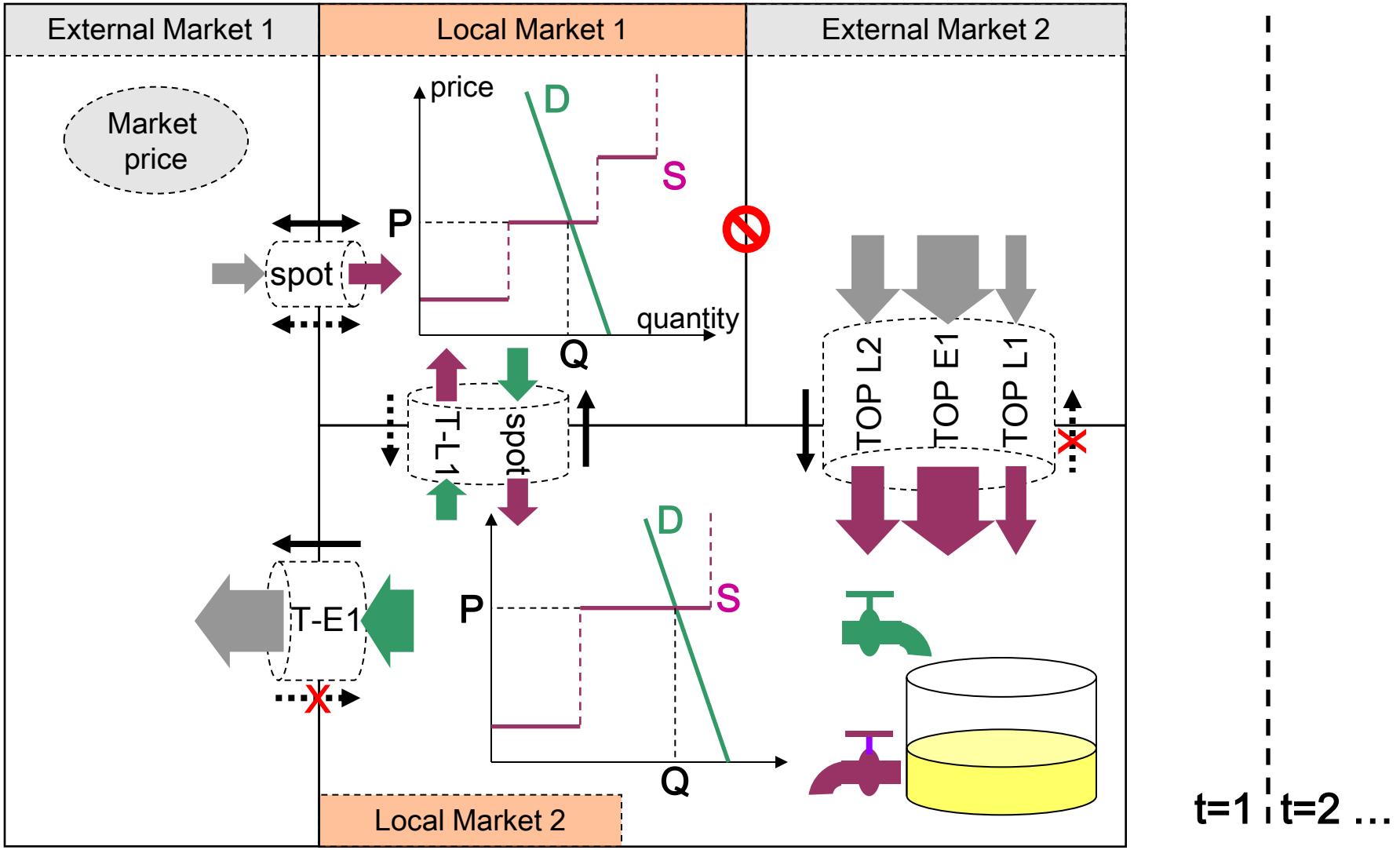
One gas year – 12 months



Summary of modelling input parameters and data sources

Category	Data Unit	Source
Consumption	Annual Quantity (bcm) Monthly distribution (% of annual quantity)	Energy Community data, Eurostat, ENTSO-G
Production	Minimum and maximum production (mcm/day)	Energy Community data, ENTSO-G
Pipeline infrastructures	Daily maximum flow	GIE, ENTSO-G, Energy Community data
Storage infrastructures	Injection (mcm/day), withdrawal (mcm/day), working gas capacity (mcm)	GSE
LNG infrastructures	Capacity (mcm/day)	GLE
TOP contracts	Yearly minimum maximum quantity (mcm/year) Seasonal minimum and maximum quantity (mcm/day),	Gazprom, National Regulators Annual reports, Platts

Model scheme



Reference Scenario for Two Characteristic Years

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2015 compared to 2011

- Major changes compared to 2011:
- Demand and production modified according to available 2015 forecasts
- New infrastructures added to the latest GIE infrastructure setup:
- New (bi-directional) lines: HU-SK, MV-RO, reverse-flow projects: HU-AT, RO-HU, BG-RO, PL-CZ, SI-AT, HR-SI
- South Stream project: TR-BG, BG-SB, SB-HU, HU-SI, SI-IT pipelines (10 bcm is shipped to Italy under a TOP regime with allowing backhaul up to 1,5 bcm)
- Storage tariffs reflect the prices set by storage operators for 2013
- Tariffs capped at 5,30 €/MWh, i.e. 105% of the EFS's price (5,05 €/MWh)
- TOPs expiring between 2011 and 2015 (HU, BG, HR) renewed with a reduced rate of annual contracted capacity (80% of the former contract)

2020

- Demand and production modified according to available 2020 forecasts.
- Infrastructure added according to latest TYNDP excluding the analysed projects

Welfare impact calculation for each project

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Welfare calculation

- In calculating economic welfare, consumer surplus, producer surplus, storage operator profit, long term contract holders' profit and TSO auction revenues are used
- They are weighted equally
- The welfare of the whole Energy Community was measured – at the same time eligibility check for the impact of projects on at least two countries:
- Welfare is quantified without and with each of the projects
- Difference is used as an input for the CBA - $\Delta SW(normal)$

SoS calculations

- Security of supply benefits of a project were simulated by first measuring economic welfare change due to the project in the context of a partial discontinuation of gas supply.
- Partial discontinuation means a 30% supply drop on the interconnectors from Russia/Ukraine in January to the region.
- Economic welfare change due to the realization of the proposed infrastructure was calculated as the difference between welfare under the partial discontinuation with and without this project. - $\Delta SW(SoS)$

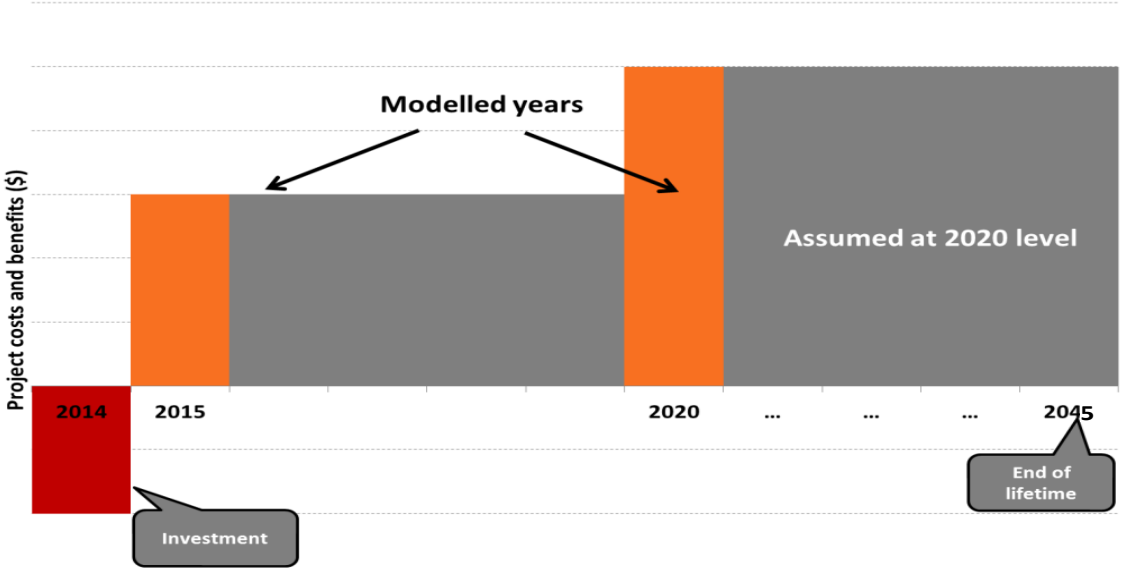
Total social welfare and NPV calculation

Total social welfare change calculations	▪ Then the probability of a supply cut will be used to weight the results under normal situation and situation with discontinued supply to calculate the overall welfare effect of the project in question. - 0,9*ΔSW(normal)+0,1*ΔSW(SoS) ▪ The CO2 emission of the change in natural gas consumption was calculated, and carbon costs are added to the benefits. For the CO2 price, the latest EU reference was used.

NPV calculations	▪ Project evaluation
	  ▪ One by one; all enter the market by 2015
	  ▪ Uniform 30 years lifetime assumed
	▪ Investment costs are born in the previous year.
	▪ Rate of return: 5%

Source on CBA: FSR THINK Report (2013)

Projects' costs and benefits for NPV calculations



Change in net welfare benefits under *normal scenario*

Probablitiy of normal scenario (0.9) X ΔSW(normal)

Change in net welfare benefits under *security of supply scenario*

Probablitiy of SoS scenario (0.1) X ΔSW(SoS)

\+ Carbon costs/savings = Δ total SW

An illustration for analysis output

Project			2015				2020				CBA results	
Project ID	Project description	Investment cost	Welfare change (normal)	Welfare change (SOS)	CO2 quota cost saving change	Total welfare change	Welfare change (normal)	Welfare change (SOS)	CO2 quota cost saving change	Total welfare change	NPV	Score Scale 1 (min) to 5 (max)
	Calculation Method	Input	Model	Model	Model	D*0,9+E*0,1+F				H*0,9+I*0,1+J		Scaling
		million €	million €	million €	million €	million €	million €	million €	million €	million €	million €	
G0XX	Interconnector to a new market	16	69	68	-1	68	69	70	-2	67	1 022	4,2
G0XX	LNG	617	40	38	-1	39	89	185	-2	97	620	3,8
G0XX	Interconnector between existing markets	94	-1	-2	0	0	37	38	-4	33	271	3,1
G0XX	Storage	37	0	0	0	0	0	1	0	0	-37	2,7

Aggregate benefits can be broken down by countries/zones and market participants

Some comments on the final results

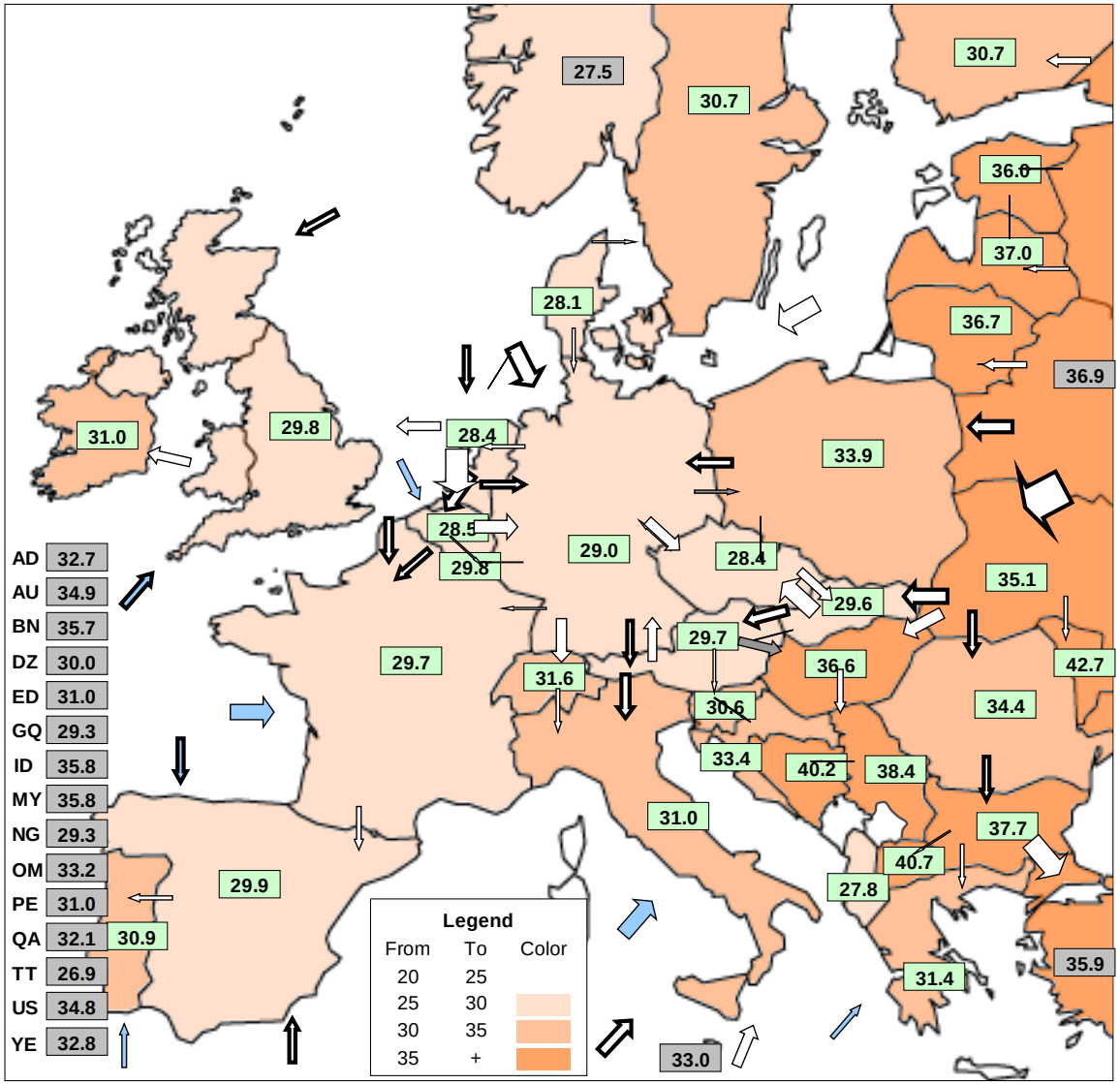
- Projects bringing gas to not yet gasified markets rank very high
- LNG projects perform very well.
- Storage projects have very limited effect on wholesale prices

Sensitivity analysis

- (1) South stream is part of the reference scenario network
- (2) Low demand scenario (5%↓ in 2015, 10%↓ in 2020)
- (3) High demand scenario (5%↑ in 2015 and by 15% ↑by 2020)

Project ID	Project Name
G002	EAGLE LNG Terminal
G008	Ionian Adriatic Pipeline (IAP)
G022	Trans Adriatic Pipeline (TAP)
G017	Transport Gas Pipeline Nis (RS) - Pristina (Kosovo*)
G015	Interconnection Pipeline RS - ME
G010 + G011	LNG Terminal in Croatia + Pipeline Zlobin-Bosiljevo-Sisak-Kozarac-Slobodnica
G007	Interconnection Pipeline BiH - HR (Lička Jesenica-Tržac-Bosanska Krupa)
G006	Interconnection Pipeline BiH - HR (Slobodnica-Bosanski Brod-Zenica)
G005	Interconnection Pipeline upgrade Batajnica (RS) - Zvornik (BiH)
G003	Interconnection Pipeline BiH - HR (Ploce - Mostar - Sarajevo/Zagvozd - Posušje/Travnik)
G021	Modernization of Urengoy-Pomary-Uzhgorod Pipeline
G014	Interconnection Pipeline RS - FYR of MK
G023	Gas interconnector RS-HR
G018	Underground Gas Storage Banatski Dvor
G019	Underground Gas Storage Banatski Itebej
G016	Interconnection Pipeline RO - RS
G004	Interconnection Pipeline RS - BiH - HR
G009	Interconnection Pipeline HR - RS (Slobodnica-Sotin-Bačko Novo Selo)
G012	Cazaclia Underground Gas Storage
G013	Interconnection Pipeline RS - BG
G020	LNG Terminal Ukraine

European Gas Market Model – ready to use

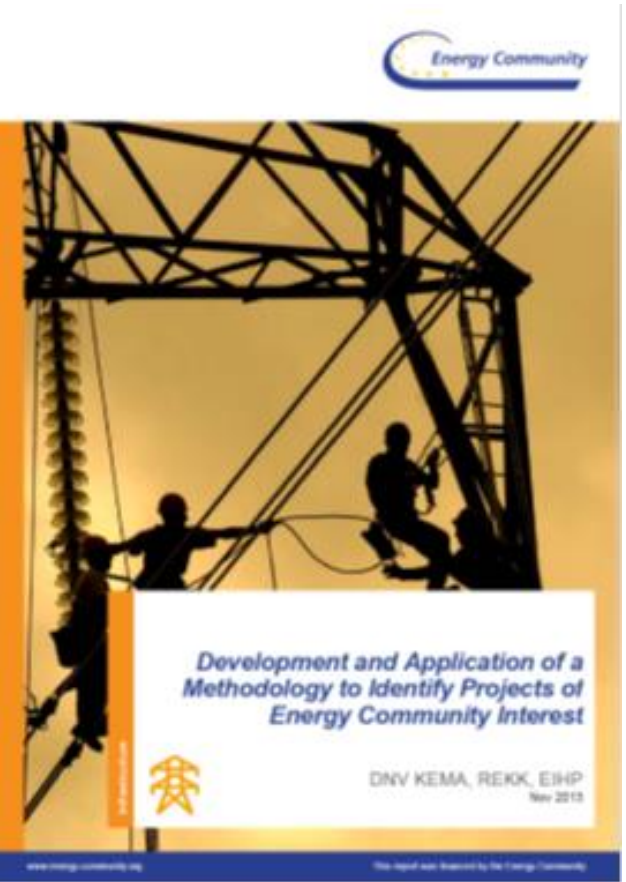


- Outside markets: NO, RU, TR, LNG (grey box)
- Endogenous markets (green)
- Arrows (modelled gas flow)
- Bold: much larger flow
- Grey: congested interconnector
- Blue: LNG)
- Global LNG markets are represented by Japanese LNG prices

EGMM is ready to use!

- Whole Europe is modelled – external markets: Japan, Norway, Russia
- Global LNG market is represented by Japanese LNG prices adjusted by transportation costs
- LNG constraints are taken into account (gasification and regasification capacity)
- Transmission tariffs are actual 2013 tariffs both for pipeline and for LNG terminals

THANK YOU FOR YOUR ATTENTION!



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